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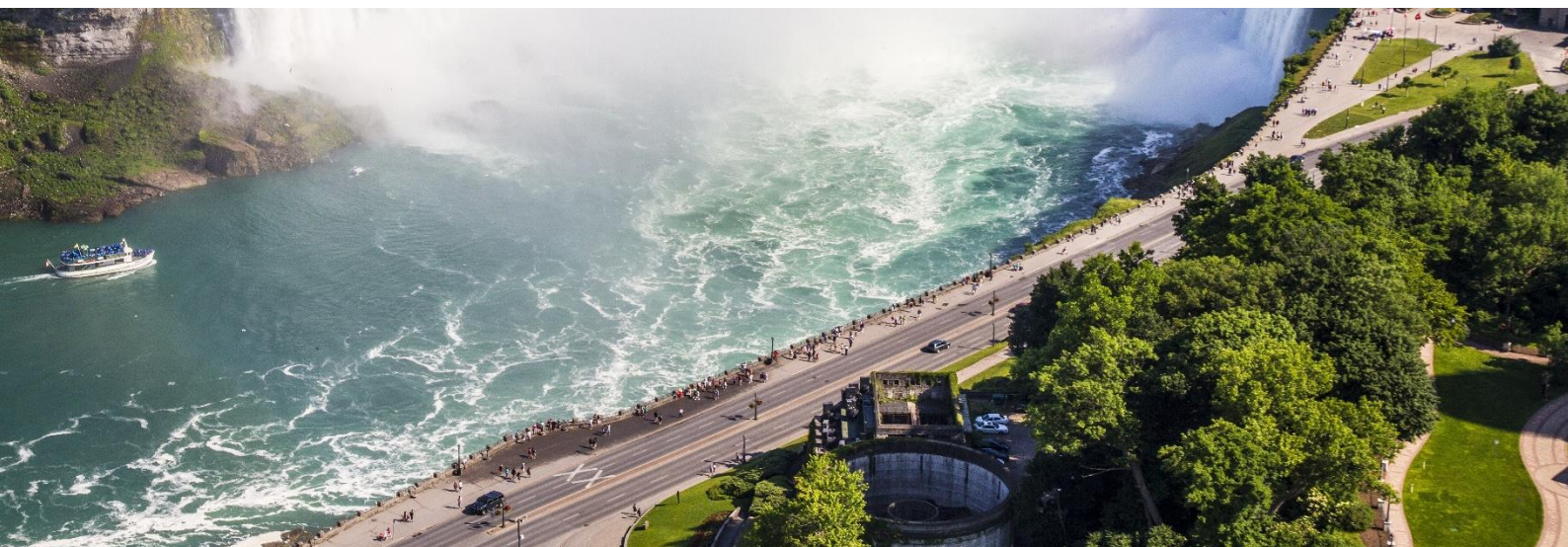
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SITE BASED STORMWATER MANAGEMENT PLAN FOR PROPOSED DEVELOPMENT AT 26 Clarks Rd, Loganholme QLD 4129

PREPARED DATE: 22/03/2021

VERSION: 1



PROJECT INFORMATION	
Site Address:	26 Clarks Rd, Loganholme QLD 4129
RP Description	Lot 4 on RP111785
DRW Job Reference:	4484
Council Ref:	Logan City Council (LCC)
Authorised by:	A. K. SANI
Signature:	
RPEQ No:	10697

DOCUMENT CONTROL

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Document Register

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1 EXECUTIVE SUMMARY

DRW Consulting Pty. Ltd. (DRW) has been engaged to prepare a Site-based Stormwater Management Plan (SWMP) for the proposed development at 26 Clarks Rd, Loganholme. The land parcel is legally described as Lot 4 on RP111785 located within the Logan City Council.

The development proposes to subdivide the existing lot into four lots. This report is prepared to support the development and provides a site-based stormwater design to ensure the stormwater runoff from the site does not result in actionable nuisance or worsening of discharge to any properties within its vicinity (upstream, downstream or adjacent to the site) and cast adverse impact on flooding or the peak discharge flow and duration for all storm events up to the 1% AEP (Annual Exceedance Probability) storm events.

Hydrological analyses are carried out using run-off routing technique through XP-Storm-2016. Through the numerical simulation and the validation/calibration using the Rational Method, it is identified that the proposed development will cause considerable flow increase. To mitigate the flow increase, an above-ground detention tank is proposed for each lot.

2 INTRODUCTION

2.1 SITE OVERVIEW

The subject site is located within Logan City Council. The development site has a total area of approximately 0.1981 ha. The majority site is covered with grass land and surrounded by existing residential development. The site is bounded by Clarks Road (to the north), as shown in Fig 2.1 below. The site is generally flat and slopes at approximately 0.5% North to South.



Figure 2.1 Site Locality

2.2 OBJECTIVES AND SCOPE

The objectives of this report are as listed below:

- To nominate the location of the Lawful Point of Discharge (LPD) for the development site.
- To simulate the stormwater runoff flow of pre- and post- development scenarios, identify the flow increase, if any
- If required, to propose stormwater detention system to ensure that stormwater runoff discharge from the post-development scenario is no more than the discharge from pre-development scenario for all storm events up to 1% AEP.
- To propose stormwater quality treatment measurements for the proposed development to meet SPP water quality objectives, if required.

2.3 SITE SITUATION

2.3.1 EXTERNAL CATCHMENT ANALYSES

An investigation has been undertaken into the surrounding area to determine the existence and extent of any external catchments contributing flows toward the subject site. It is observed that the developed site is at relative high ground comparing to its vicinity. It is therefore considered that no upstream area is contributes to the proposed development.

It is envisaged that no flows from the external upstream area will contribute to the development site. Flows from Clarks Road are diverted by the stormwater infrastructure along Clarks Road, which will not contribute any flow to the proposed site. Hence, no extra stormwater flows from upstream catchment are required to be managed.

2.3.2 EXISTING LAND USE AND STORMWATER DISCHARGE

The site is currently used as residential land with a residential dwell and multiple sheds. The site access and a concrete driveway is located at the north-west of the site. One existing kerb adaptor is observed along the frontage of the development site. Majority of the site is covered by grass and trees. The site is generally flat with an average slope of 0.5%, as shown in Appendix A. The site area composition is presented in Table 2.1.

Table 2.1 Detailed site configuration

	Roof area (ha)	driveway area (ha)	Pervious area (ha)	Total area (ha)
Area	0.0255	0.0037	0.1689	0.1981
Slope	2%	0.5%	0.5%	-

2.3.3 PROPOSED LAND USE AND STORMWATER DISCHARGE

This development proposes to subdivide the land into four lots. A driveway access is proposed for the two rear lots. The existing building, sheds and driveway are proposed to be demolished. A series of field inlet pits and stormwater pipe are proposed to convey the stormwater runoff. Based on QUDM-2016, for a property within the medium residential zoning, the recommended impervious area percentage is minimum 40%. For this development, 45% is assumed for each lot as impervious area fraction.

Detailed concept stormwater drainage design layout is presented in Appendix F.

Table 2.2 Detailed site configuration

	Roof area (ha)	Driveway area (ha)	Pervious area (ha)	Total area (ha)
Area	0.0823	0.0153	0.1005	0.1981
Slope	2%	1%	0.2%	-

3 LAWFUL POINT OF DISCHARGE

In accordance with Queensland Urban Drainage Manual (QUDM 2016) section 3.4, a Lawful Point of Discharge (LPD) must be demonstrated when proposing a development. Section 3.4.1 outlines a two-point test to assess whether a lawful point of discharge exists for a development that consists of the following:

- (i) The location of the discharge is under the lawful control of the local government or other statutory authority from whom permission to discharge has been received. This will include park, drainage or road reserve, stormwater drainage easement
- (ii) In discharging to that location, the discharge will not cause an actionable nuisance (i.e. a nuisance for which the current or some future neighbouring proprietor may bring an action or claim for damages arising out of the nuisance), or environmental or property damage.

Along the frontage, an existing grated pit is observed near the north-east corner. It is proposed that the stormwater runoff from proposed Lot 4 will be discharged to the pit as its PPD. For Lots 1-3, the stormwater from the site will be conveyed to the proposed manhole 1/1 and eventually discharged to the existing kerb side gully pit as LPD.

4 STORMWATER QUANTITY ANALYSES: HYDRAULIC MODELLING

In order to identify the impact of the proposed development to the existing environment, hydraulic models were developed using XPSTORM (2016.1). In this section, the modelling procedures and hydraulic analyses are explained. The modelling procedures were summarised in Fig. 4.1.

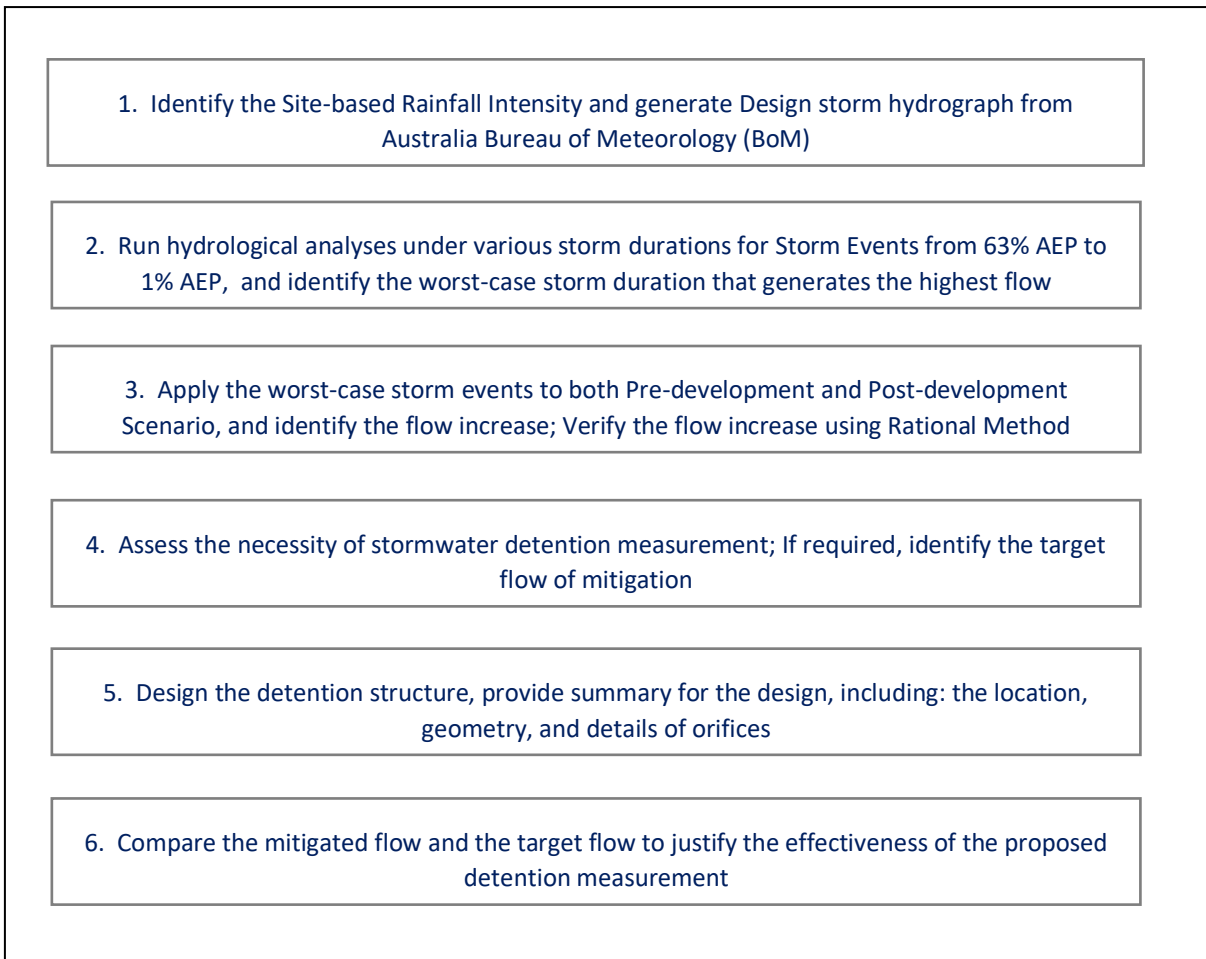


Fig. 4.1 Procedure for stormwater detention structure design

4.1 GENERATION OF DESIGN RAINFALL HYDROGRAPH

This report applies the site-specified rainfall information including: Intensity, Frequency, and Duration (i.e. IFD). The geographical location of the development site is on coordinates (27.69S, 153.19E). Based on the up-to-date information from BoM, the rainfall intensity for various durations of storm events from 63% AEP to 1% AEP are calculated, as summarized in Appendix E. The rainfall intensities are applied in a hydrological model through XPstorm-2016.1, and design rainfall hydrographs are generated.

4.2 MODELLING PARAMETERS AND STRATEGY

XPSTORM (2016.1) is applied to perform hydrological modelling using SWMM computational method. Amongst many runoff-routing methods, Laurenson method is applied for this analysis. This method requires that each catchment to be split into pervious and impervious sub-areas, and route stormwater runoff through non-linear catchment storage using separate hydrographs from pervious and impervious portions.

The complicated surface characteristics can be simulated by nominating appropriate Manning’s roughness for both Pervious and Impervious sub-areas. Manning Roughness coefficient (n) are summarised in Table 4.1.

Table 4.1 Manning’s roughness summary

	Impervious area	Pervious area
Manning’s Roughness (n)	0.013	0.030

Laurenson's Method allows the use of Initial and Continuing Losses in considering the infiltration. Initial Loss (IL) and Continuing Losses (CL) have been applied to the hydrological model. QUDM-2016 suggests referring to the Australian Rainfall & Runoff (ARR) for guidance. In section 3.5 of Book 5 of ARR, recommendations for the IL & CL are adopted. In particular, IL value of urban pervious area is suggested to be 10mm – 30mm. The IL value of effective impervious is suggested to be 1mm – 2mm. Details of the applied IL and CL parameters are presented in Table 4.2.

Table 4.2 Adopted Initial & Continuing Losses

100% Impervious Area		0% Impervious Area	
IL (mm)	CL (mm/hr)	IL (mm)	CL (mm/hr)
1	0	10	2.5

4.3 MODELLING OF PEAK DISCHARGE AND IMPACT ASSESSMENT

Hydraulic studies are carried out for both minor storm event (10% AEP) and major storm event (1% AEP). For each AEP storm event, various storm durations are applied, including: 10mins, 20mins, 25mins, 30mins, 45mins, 60 mins, 90mins. It is generally observed that 60mins is the storm duration that consistently produced the highest flow amongst other storm durations, as shown in Appendix C.

Therefore, the storm duration of 60 minutes is determined to be the critical storm duration for the impact assessment, and the entire rainfall event is designed to be 3 hours.

To identify the flow increase due to the development as above-mentioned, the pre- and post-development scenarios are modelled simultaneously with the same infiltration parameters across various rainfall events. Flow hydrographs from storm events with 60 minutes duration with various AEPs are summarised for both pre- and post-developments in Fig. 4.1.

It can be observed that with the declining of AEP the flow consistently increases for both pre- and post-development scenarios. In addition, the flow from the post-development site is obviously concentrated and intensified.

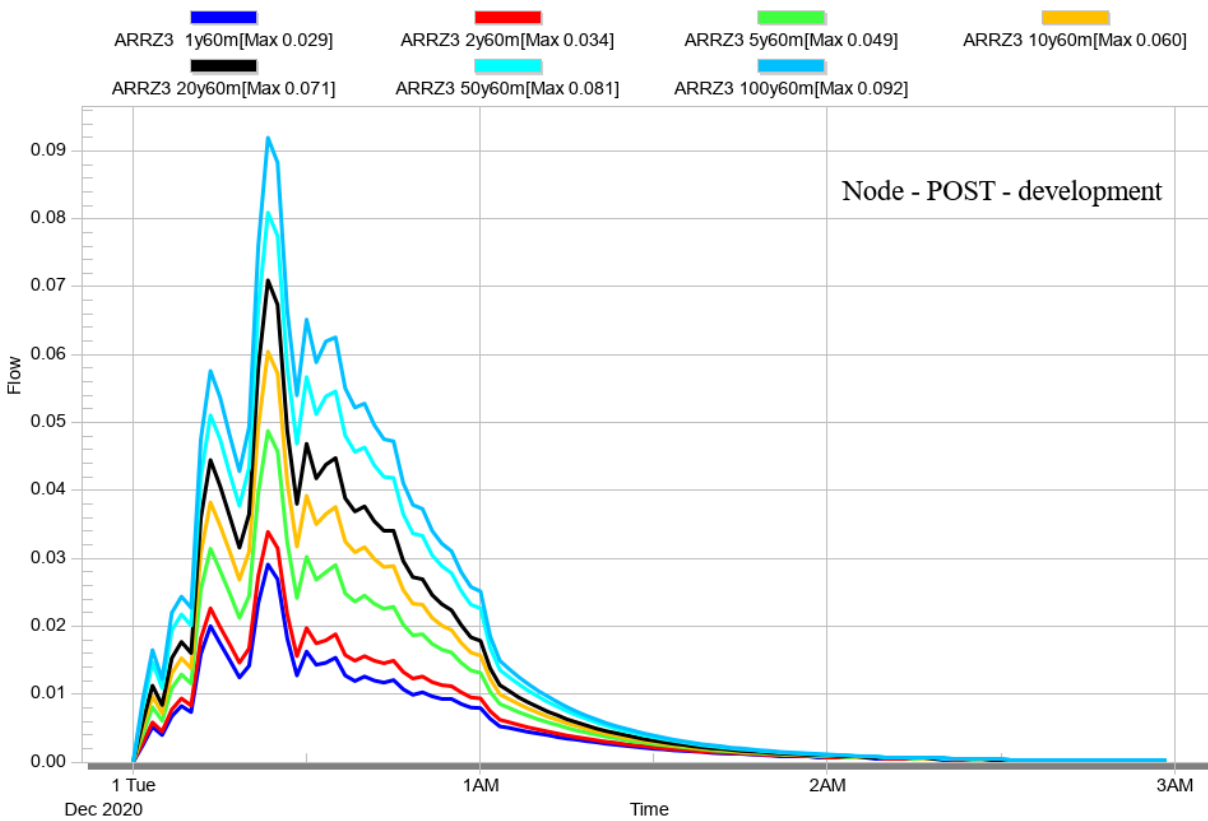
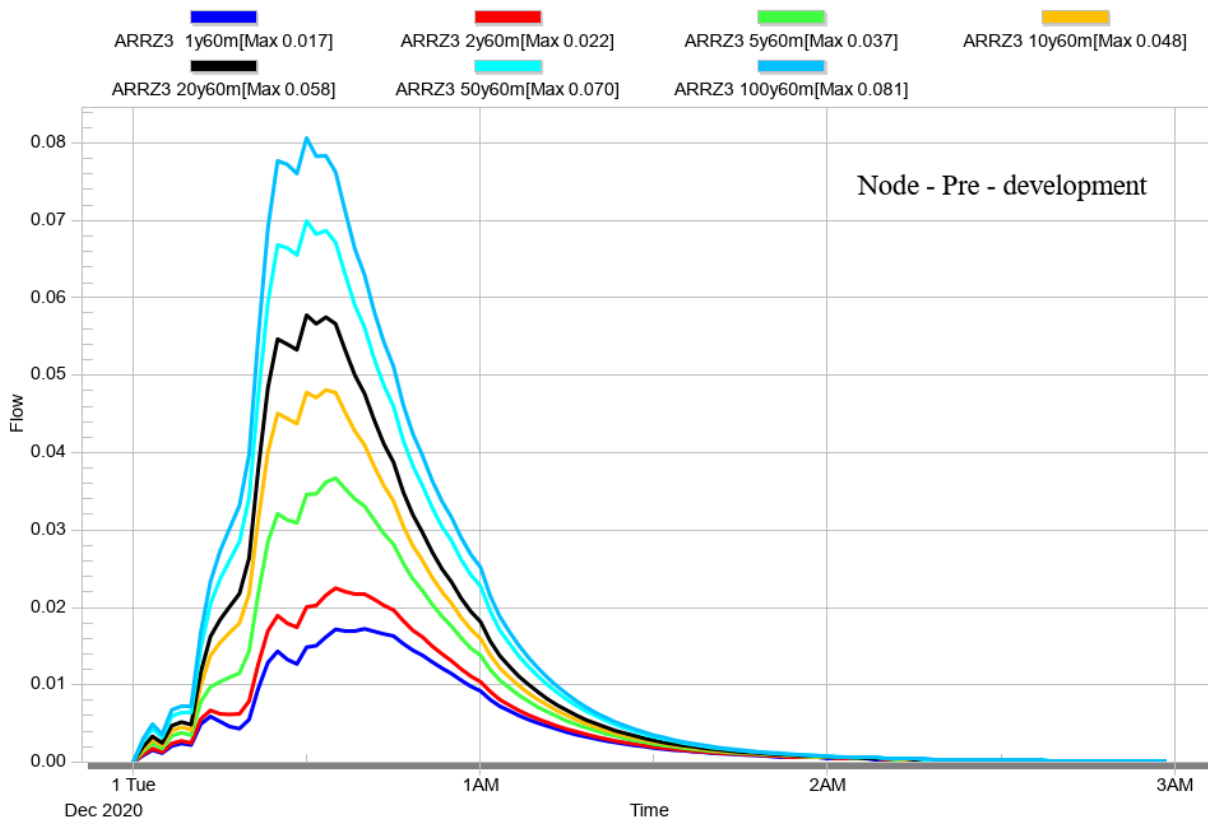


Fig. 4.1 Flow results for various AEPs storm events at 60mins duration

To further assess the impact due to the proposed development, the peak flows of storm events with various AEPs are extracted from Fig. 4.1, as tabulated in Table 4.3.

Table 4.3 Flow comparison between pre- and post- development from XPSTORM Model

Storm Event	Peak Flow Pre-development (m ³ /s)	Peak Flow Post-development (m ³ /s)	Difference (m ³ /s)	Difference (L/s)
63% AEP, 60min	0.017	0.029	0.012	12
39% AEP, 60min	0.022	0.034	0.012	12
20% AEP, 60min	0.037	0.049	0.012	12
10% AEP, 60min	0.048	0.060	0.012	12
5% AEP, 60min	0.058	0.071	0.013	13
2% AEP, 60min	0.070	0.081	0.011	11
1% AEP, 60min	0.081	0.092	0.011	11

It can be observed that the proposed development produces a maximum of 12 L/s increase in flow discharge from storm events up to 1% AEP, which is considerable. Therefore, on-site stormwater detention devices are necessary for the proposed development, so that the peak flow from the post-development scenario is no greater than the pre-development scenario.

To validate the modelling results above, Rational Method is also applied to estimate the discharge with detailed calculation presented in Appendix D. Table 4.4 summarises the peak flows of various storm events.

Table 4.4 Peak flow results from Rational Method

Storm Event	Peak Flow Pre-development (m ³ /s)	Peak Flow Post-development (m ³ /s)	Difference (m ³ /s)	Difference (L/s)
63% AEP, 60min	0.021	0.025	0.003	3
39% AEP, 60min	0.026	0.030	0.004	4
20% AEP, 60min	0.039	0.045	0.006	6
10% AEP, 60min	0.048	0.056	0.008	8
5% AEP, 60min	0.058	0.067	0.009	9
2% AEP, 60min	0.074	0.085	0.012	12
1% AEP, 60min	0.085	0.099	0.013	13

It must be noted that the XPSTORM numerical model and Rational Method are different methods in nature. Rational method is a mathematical model, which is only recommended to provide general storm peak discharge without the capacity of considering the infiltration and runoff storage. Whereas, the XPSTORM model is a hydrological model based on runoff routing technique considering the necessary infiltration and site-specified design storm events. Result differences from the two methods are expected.

However, both modelling results show reasonably comparable results, and consistently indicate that the development will create actionable flow nuisances. Therefore, it is determined that stormwater a detention device is required to mitigate the increased flow discharge.

4.4 MODELLING OF DETENTION DEVICES

For all the storm events, the mitigation strategy is designed as follows:

The stormwater runoff from roof area for each lot will be collected to an above-ground detention tank for mitigation, stormwater from driveway and landscaping area will become surface runoff, be collected by multiple pits and pipes as by-pass area without flow mitigation.

The strategy is to ensure the mitigated flows from the total roof areas together with the unmitigated flow from the by-pass area from the post-development scenario does not exceed the flow discharge from the pre-development scenario. Therefore, the target total flows from the development site are the flows from the pre-development scenario in table 4.3, as shown in Table 4.5.

Table 4.5 Target flows of mitigation

Storm Event	63% AEP, 60min	39% AEP, 60min	20% AEP, 60min	10% AEP, 60min	5% AEP, 60min	2% AEP, 60min	1% AEP, 60min
Target flow after mitigation (m³/s)	0.017	0.022	0.037	0.048	0.058	0.07	0.081

Based on the above-mentioned strategy, an XPstorm model is developed, Both roof area and by-pass area are modelled, as shown in Fig. 4.2.



Fig. 4.2 XP-storm model layout

For each lot, an above-ground detention tank is proposed to mitigate the stormwater from roof area. For each tank, multiple orifices at various heights are designed, so that the sum of the total mitigated flow from four tanks and the flow by-pass pervious area is no more than flow discharge from the pre-development scenario.

For each detention tank, the outlet flow hydrographs and the water levels inside the tank for various AEPs are obtained through the hydrological model. The results are presented in Appendix E. The outlet flow discharge from every proposed detention tank is the sum of the flows from the proposed orifices. The results are summarised in Appendix F, as well as the by-pass flow hydrographs for all storm events.

In order to assess the efficiency of the proposed detention tanks, the outlet flows from four detention tanks are summarized as “total detention tank outlet peak flow”, for each storm event, the total outlet flows from detention tanks are summarized in Table 4.6.

Table 4.6 Flow outcome assessment

Storm Event	Target peak flow of mitigation (m³/s)	Total detention tank outlet peak flow (m³/s)	By-pass peak flow (m³/s)	Total mitigated post-development peak flow (m³/s)
63% AEP, 60min	0.017	0.006	0.008	0.014
39% AEP, 60min	0.022	0.008	0.010	0.018
20% AEP, 60min	0.037	0.022	0.016	0.038
10% AEP, 60min	0.048	0.028	0.022	0.050
5% AEP, 60min	0.058	0.028	0.027	0.055
2% AEP, 60min	0.070	0.032	0.034	0.066
1% AEP, 60min	0.081	0.034	0.040	0.074

As described earlier, the total detention tank outlet flow and the flow from by-pass area should be no more than the flow from pre-development scenario. It can be observed that the proposed detention system successfully achieves the target of “no worsening”. Only for 20% AEP storm event, the total flow after mitigation exceeds 2 L/s, which is deemed to be negligible.

5 STORMWATER QUALITY ANALYSES

5.1 STORMWATER QUALITY OBJECTIVES

The assessment criteria from the State Planning Policy (July 2017) (SPP) for water quality in the interest of the State are summarised in Table 5.1.

Table 5.1 Development Applications affecting Receiving Waters

State Planning Policy Criteria	Application to Development
<p>(1) A material change of use for an urban purpose that involves premises 2500 m² or greater in size and:</p> <p>(a) will result in six or more dwellings; or</p> <p>(b) an impervious area greater than 25 per cent of the net developable area.</p>	Not applicable.
<p>(2) Reconfiguring a Lot for urban purposes that involves premises 2500 m² or greater in size AND will result in six or more Lots; or</p>	The development involves premises less than 2500 m ² , and only results in four lots.
<p>(3) Operational works for an urban purpose that involves disturbing a land area 2500 m² or greater in size.</p>	The disturbed area involves less than 2500m ² .

It can be observed that the proposed development does not trigger any of the criteria of stormwater quality policy. Therefore, stormwater quality shall be managed in accordance with best management practices.

6 CONCLUSIONS & RECOMMENDATIONS

6.1 PROPOSED STORMWATER MANAGEMENT PLAN

Through the developed hydrological model, it is determined that the unmitigated proposed development would result in the increase of stormwater flow discharge. This conclusion is also verified by the Rational Method calculation. Hence, the development, if unmitigated, could potentially cause actionable nuisance to the downstream property(s). Therefore, for each lot a 5kL stormwater detention tank is proposed to mitigate the roof water, to achieve the target of “no worsening”.

6.2 RECOMMENDATIONS

6.2.1 CONSTRUCTION PHASE

Prior to commencement of construction, an Erosion and Sediment Control Plan (ESCP) will be implemented to minimise the impacts on stormwater quality. The plan will address site and catchment specific erosion control measures, generally adhering to the following control measures.

6.2.2 PRE-CONSTRUCTION

Before construction the following measures will be established and maintained for any to be disturbed:

- Sediment fences to be erected;
- Stockpile areas to be designated to minimise impacts on site runoff; and
- Provision of shakedown pit for any entry/exit points to the site.

6.2.3 DURING CONSTRUCTION

- Construction related activities will be contained within the subject site where possible to minimise areas of disturbance.
- Topsoil retention for site rehabilitation.
- Regular inspection of sediment control measures; and
- Contractor's Construction Management Plan to include day to day management requirements.

6.2.4 POST CONSTRUCTION

Following construction any disturbed areas will be stabilised through revegetation which is to be maintained until established.

6.2.5 OPERATIONAL PHASE

Building applications for future dwellings on the allotments shall address their impacts on stormwater quality on an individual basis.

7 APPENDICES

Appendix A: SURVEY PLAN

Appendix B: RAINFALL INTENSITY & COEFFICIENTS FROM BOM

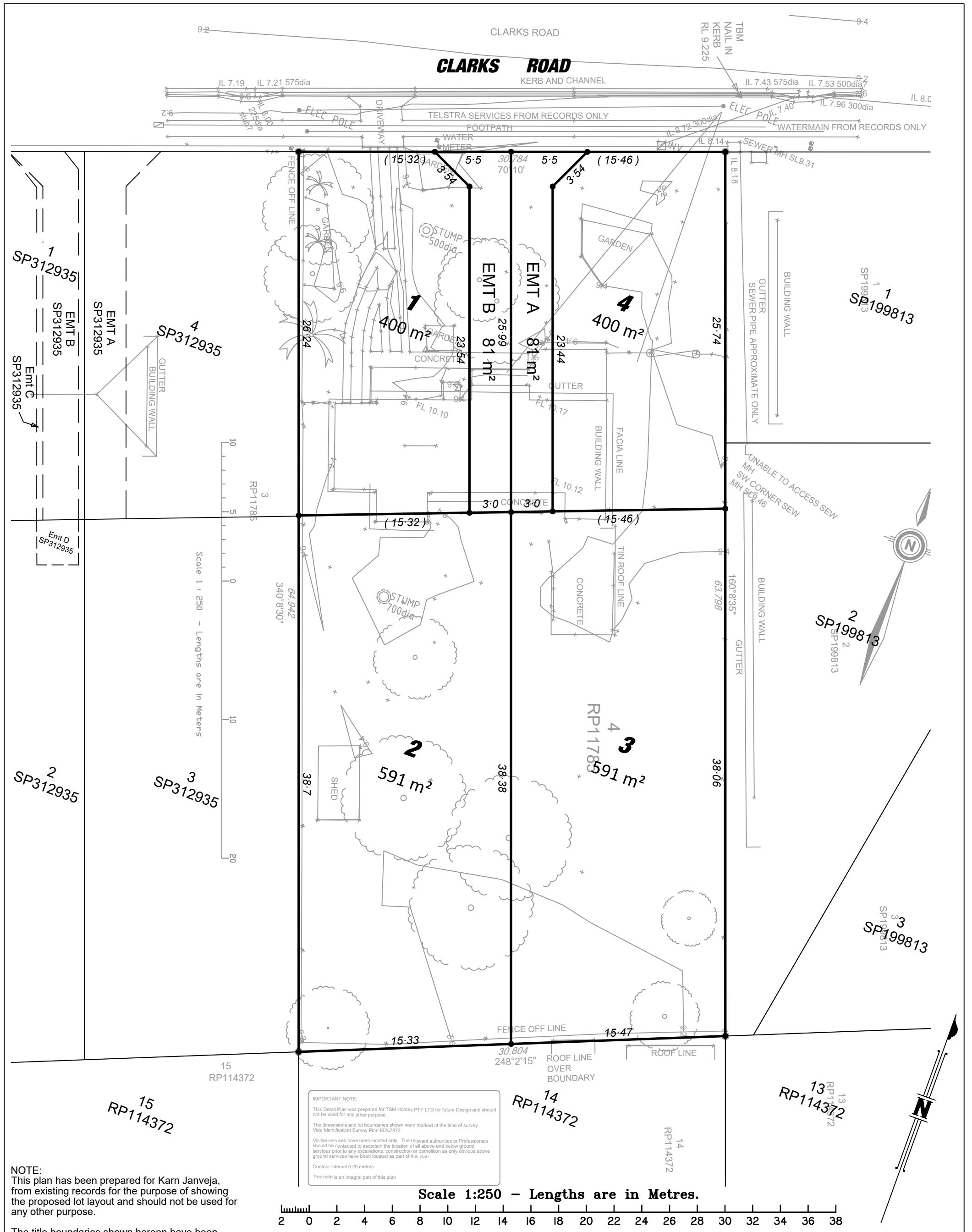
Appendix C: WORST-CASE STORM DURATION FOR MINOR & MAJOR STORM EVENTS

Appendix D: RATIONAL METHOD CALCULATION

Appendix E: HYDROGRAPHS AND WATER LEVELS OF ALL ABOVE-GROUND DETENTION TANKS

Appendix F: STORMWATER CONCEPT LAYOUT PLAN

APPENDIX A SURVEY PLAN



IMPORTANT NOTE:
 This Detail Plan was prepared for TSM Homes PTY LTD for future Design and should not be used for any other purpose.
 The dimensions and lot boundaries shown were marked at the time of survey Vide Identification Survey Plan IS257872.
 Visible services have been located only. The relevant authorities or Professionals should be contacted to ascertain the location of all above and below ground services prior to any excavations, construction or demolition as only obvious above ground services have been located as part of this plan.
 Contour interval 0.20 metres
 This note is an integral part of this plan

NOTE:
 This plan has been prepared for Karn Janveja, from existing records for the purpose of showing the proposed lot layout and should not be used for any other purpose.

The title boundaries shown hereon have been compiled from IS257872 for plotting purposes only. All dimensions and areas are subject to final survey.
 Detail information from GM Civil+Construction Surveying Plan C380-SVY-1508101 dated 31/07/2015.
 Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of underground services and detailed locations of all services.
 This note is an integral part of this plan/file

L.A.	LOGAN C. C.
LOCALITY	LOGANHOLME
CONTOUR INT	N/A
MERIDIAN	IS257872
LEVEL ORIGIN	(see C380-SVY-1508101
DATUM	GM civil+construction surveying)
SURVEYOR	N/A
CHECKED BY	JAH
SCALE	1:250 @ A3
DATE	24/11/2020 (Rev B)

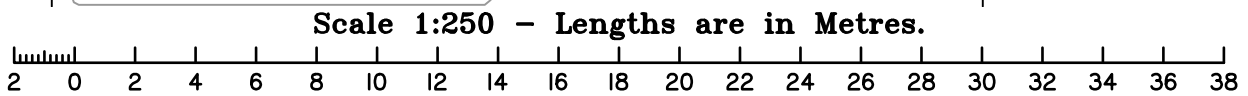
PROPOSED SUBDIVISION LAYOUT PLAN	
of Lot 4 on RP11785. 26-28 Clarks Road, Loganholme. Client - Karn Janveja	
SHEET	1 of 1

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TOWN PLANNING SURVEYING

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DRAWING No. **001147_PSLP**
 REV B



APPENDIX B RAINFALL INTENSITY & COEFFICIENTS FROM BOM

IFD Design Rainfall Coefficients

Site address: 26 Clarks Rd, Loganholme
 Property description: Lot 4 on RP111785
 Requested coordinate: Latitude 27.69 (S) Longitude 153.19 (E)

ARR - 2016

Coefficient	63% AEP	39%AEP	20% AEP	10%AEP	5%AEP	2%AEP	1%AEP
C0	0.93652332	1.0615048	1.3733517	1.5391129	1.6774782	1.8342525	1.938835
C1	0.51297301	0.51965737	0.58824414	0.65715295	0.73385084	0.83172661	0.91764134
C2	0.39469054	0.38714349	0.30709377	0.22629033	0.13624276	0.022375617	-0.078324206
C3	-0.18736	-0.18435961	-0.1512997	-0.1177551	-0.080321275	-0.033672817	0.008059577
C4	0.033537894	0.032981414	0.026794603	0.020509344	0.013492446	0.004932429	-0.002847824
C5	-0.002662231	-0.002608603	-0.002059485	-0.001507866	-0.000893719	-0.000163685	0.000511703
C6	7.78E-05	7.57E-05	5.69E-05	3.84E-05	1.80E-05	-5.59E-06	-2.79E-05

$Depth_p = e^{(C0 + C1 \ln(T) + C2 \ln(T)^2 + C3 \ln(T)^3 + C4 \ln(T)^4 + C5 \ln(T)^5 + C6 \ln(T)^6)}$							
T unit:	minutes			I Unit:	mm/hour		

Rainfall Intensity:

	63% AEP	39%AEP	20% AEP	10%AEP	5%AEP	2%AEP	1%AEP
Intensity (5 minutes)	108.411	122.909	168.720	200.118	231.070	272.212	304.077
Intensity (10 minutes)	89.728	101.625	138.251	162.533	185.840	216.136	238.790
Intensity (20 minutes)	66.146	74.918	101.977	119.961	137.258	159.770	176.653
Intensity (25 minutes)	58.612	66.403	90.579	106.771	122.441	142.949	158.453
Intensity (30 minutes)	52.735	59.763	81.709	96.524	110.953	129.950	144.429
Intensity (45 minutes)	40.948	46.453	63.922	75.961	87.879	103.826	116.227
Intensity (60 minutes)	33.846	38.432	53.166	63.475	73.802	87.795	98.829
Intensity (90 minutes)	25.657	29.183	40.688	48.894	57.239	68.738	77.959
Intensity (120 minutes)	21.039	23.964	33.595	40.539	47.660	57.577	65.599
Intensity (180 minutes)	15.946	18.205	25.707	31.174	36.826	44.785	51.272

Rainfall depth:

	63% AEP	39%AEP	20% AEP	10%AEP	5%AEP	2%AEP	1%AEP
Depth (5 minutes)	9.034	10.242	14.060	16.677	19.256	22.684	25.340
Depth (10 minutes)	14.955	16.937	23.042	27.089	30.973	36.023	39.798
Depth (20 minutes)	22.049	24.973	33.992	39.987	45.753	53.257	58.884
Depth (25 minutes)	24.422	27.668	37.741	44.488	51.017	59.562	66.022
Depth (30 minutes)	26.367	29.882	40.855	48.262	55.477	64.975	72.214
Depth (45 minutes)	30.711	34.839	47.941	56.971	65.909	77.869	87.170
Depth (60 minutes)	33.846	38.432	53.166	63.475	73.802	87.795	98.829
Depth (90 minutes)	38.486	43.775	61.033	73.341	85.858	103.108	116.939
Depth (120 minutes)	42.077	47.928	67.189	81.077	95.320	115.154	131.198
Depth (180 minutes)	47.837	54.615	77.122	93.522	110.478	134.356	153.815

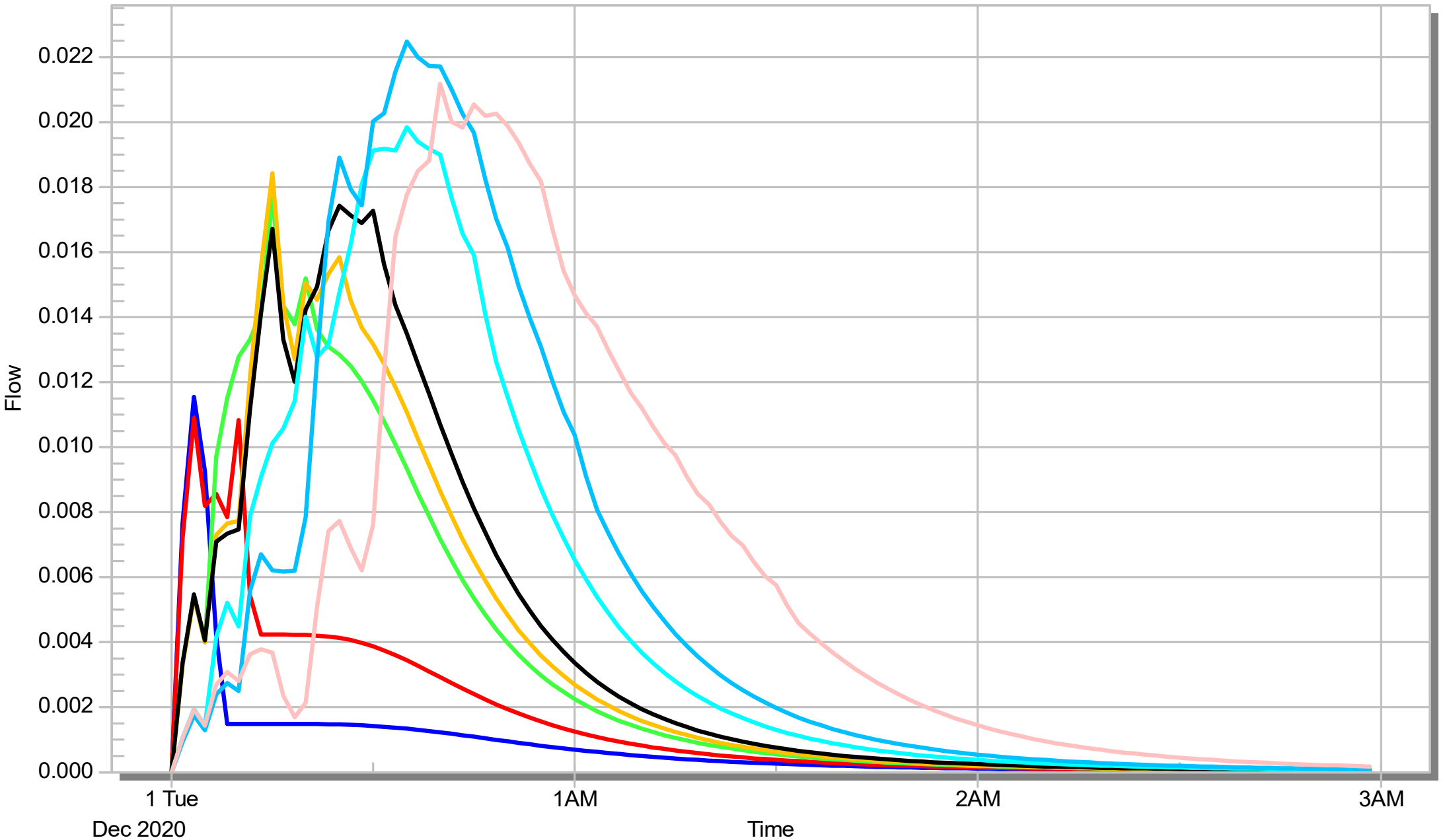
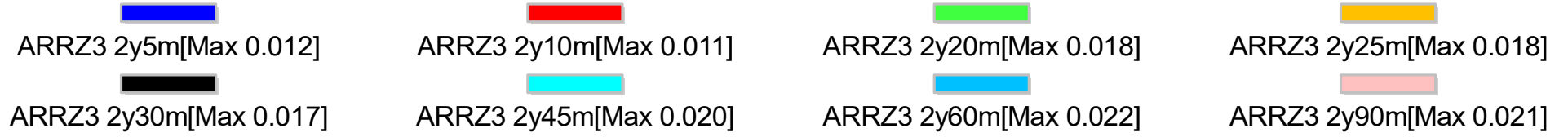
$I = \text{intensity (mm/h)} = \text{depth (mm)} / \text{duration (hours)}$

$\text{depth (mm)} = \text{intensity (mm/h)} \times \text{duration (hours)}$

APPENDIX C WORST-CASE STORM DURATION FOR MINOR & MAJOR STORM EVENTS

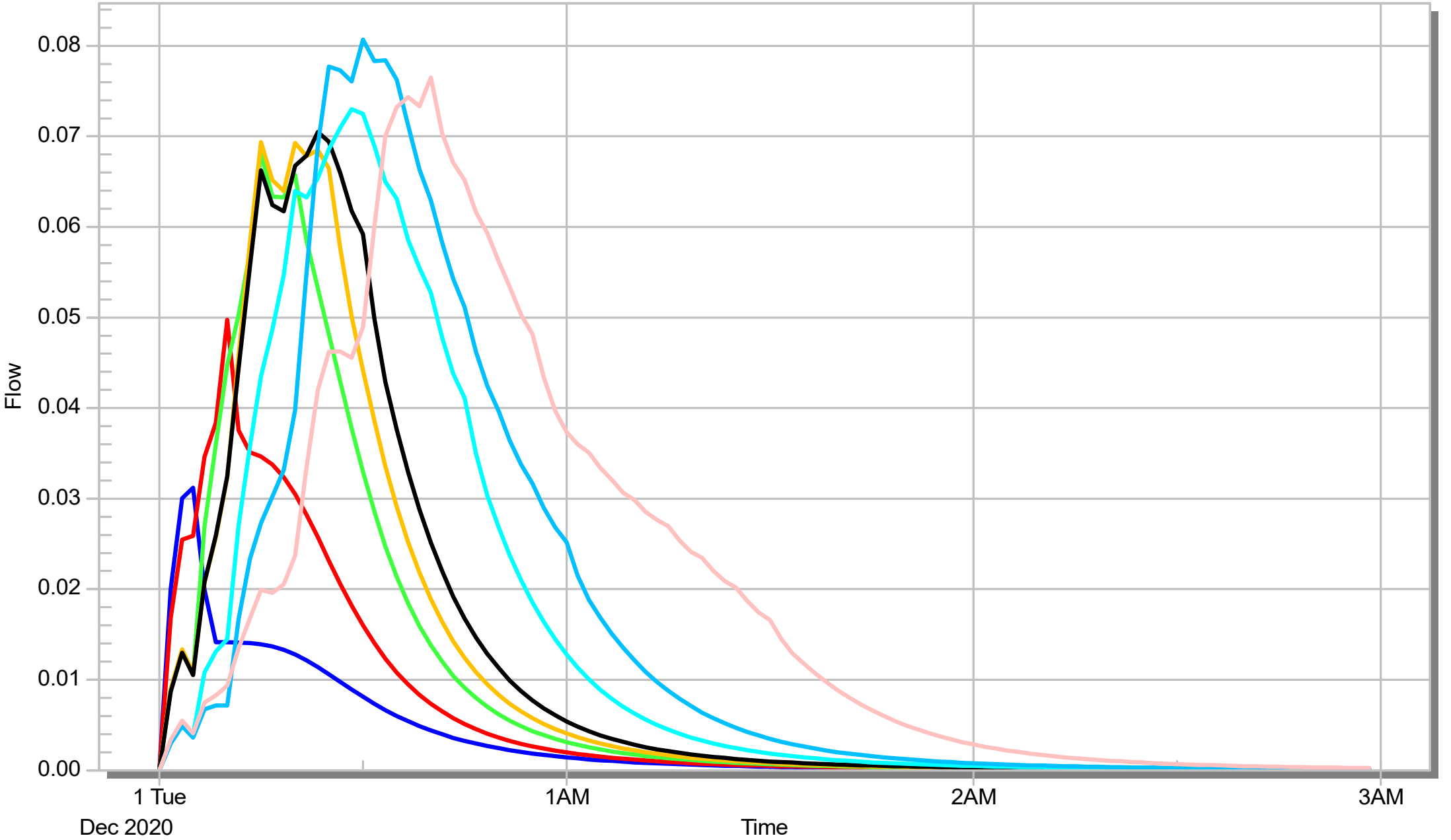
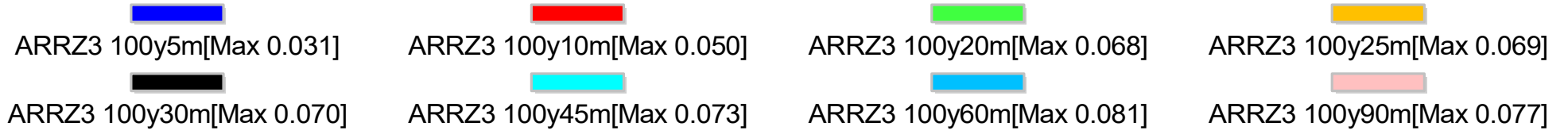
Flow results from Minor Storm Event
- 39% AEP

Node - Pre - development



Flow results from Major Storm Event
- 1% AEP

Node - Pre - development



APPENDIX D RATIONAL METHOD CALCULATION

Spreadsheet based on QUDM 2017, Section 4.3 - "The Rational Method"

Project Number	4484
Project Address	26 Clarks Rd, Loganholme

EXISTING USE		
Co-efficient of Run-Off Calculation		
Catchment Name	Area (m ²)	Co-efficient of Discharge
Impervious	292	0.900
Pervious	1689	0.700
Total Area	1981	
	Adopted C10:	0.7295

Table 4.5.3 (a) of QUDM (2017)

Table 4.5.3 (b) of QUDM (2017)

Table 4.5.3 of QUDM (2017)

PROPOSED USE		
Co-efficient of Run-Off Calculation		
Catchment Name	Area (m ²)	Co-efficient of Discharge
Impervious	975.6	0.900
Pervious	1005.4	0.700
Total Area	1981	
	Adopted C10:	0.7985

Table 4.5.3 (a) of QUDM (2017)

Table 4.5.3 (b) of QUDM (2017)

Table 4.5.3 of QUDM (2017)

T _c (min.) :	20	Figure 4.4 of QUDM (2017)
Area (ha) :	0.1981	(10,000m ² = 1 ha)

T _c (min.) :	18	Figure 4.4 of QUDM (2017)
Area (Ha) :	0.1981	(10,000m ² = 1 ha)

Flood Event AEP (%)	Existing	Post Development	RAINFALL INTENSITY		Peak Outflow Capacity (m ³ /s)	Peak Inflow Rate (m ³ /s)	Difference (m ³ /s)
	C _y = F _{y,x} C ₁₀	C _y = F _{y,x} C ₁₀	Existing	Post Development	Q ₀ (Existing)	Q _i (Post Development)	Q _i -Q ₀ (Post - Pre)
63%	0.584	0.639	66.1 mm / hr	70.1 mm / hr	0.021	0.025	0.003
39%	0.620	0.679	74.9 mm / hr	79.42 mm / hr	0.026	0.030	0.004
18%	0.693	0.759	102 mm / hr	108 mm / hr	0.039	0.045	0.006
10%	0.729	0.798	120 mm / hr	127.2 mm / hr	0.048	0.056	0.008
5%	0.766	0.838	137 mm / hr	145 mm / hr	0.058	0.067	0.009
2%	0.839	0.918	160 mm / hr	169.2 mm / hr	0.074	0.085	0.012
1%	0.875	0.958	177 mm / hr	187 mm / hr	0.085	0.099	0.013

Where Coefficients of Runoff calculated from the above equation exceed 1.00, they should be arbitrarily set to 1.00. QUDM 2017 Section 4.5

Rational Method	Rational Method
Q = CIA / 360	Q = CIA / 360

APPENDIX E HYDROGRAPHS AND WATER LEVELS OF ALL ABOVE-GROUND DETENTION TANKS

Slimline Detention Tank for Lot 1:

Detention tank	Tank base area (m2)	1.15 X 2.60
	Tank internal height (m)	1.86
	Tank Volume (KL)	5
	Base orifice diameter (mm)	20
	Distance to the tank base (m)	0.00
	1st orifice diameter (mm)	35
	Distance to the tank base (m)	0.90

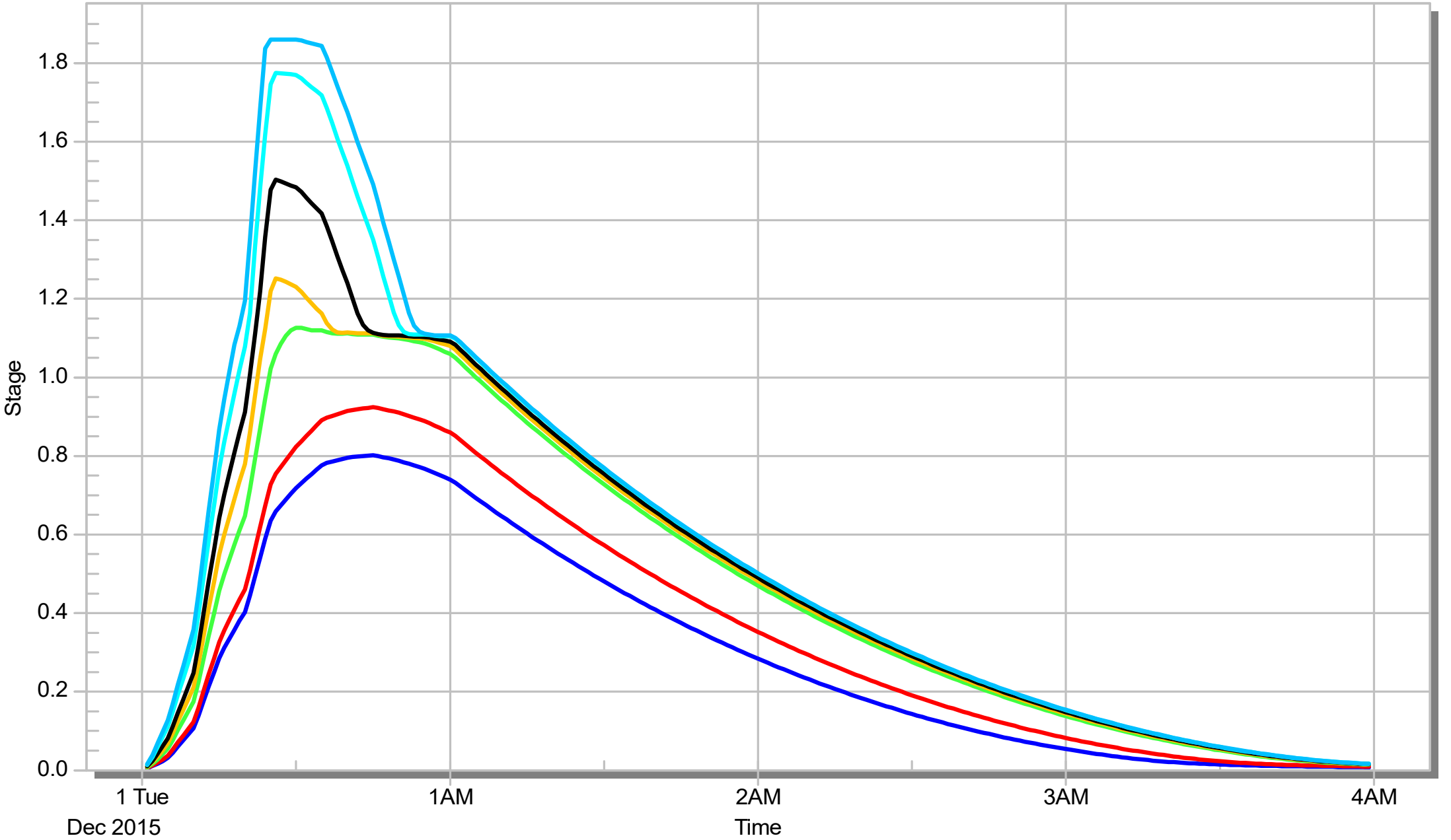
Detention Tank flow heights:

ARRZ3 1y60m[Max 0.802]
ARRZ3 20y60m[Max 1.503]

ARRZ3 2y60m[Max 0.924]
ARRZ3 50y60m[Max 1.775]

ARRZ3 5y60m[Max 1.127]
ARRZ3 100y60m[Max 1.860]

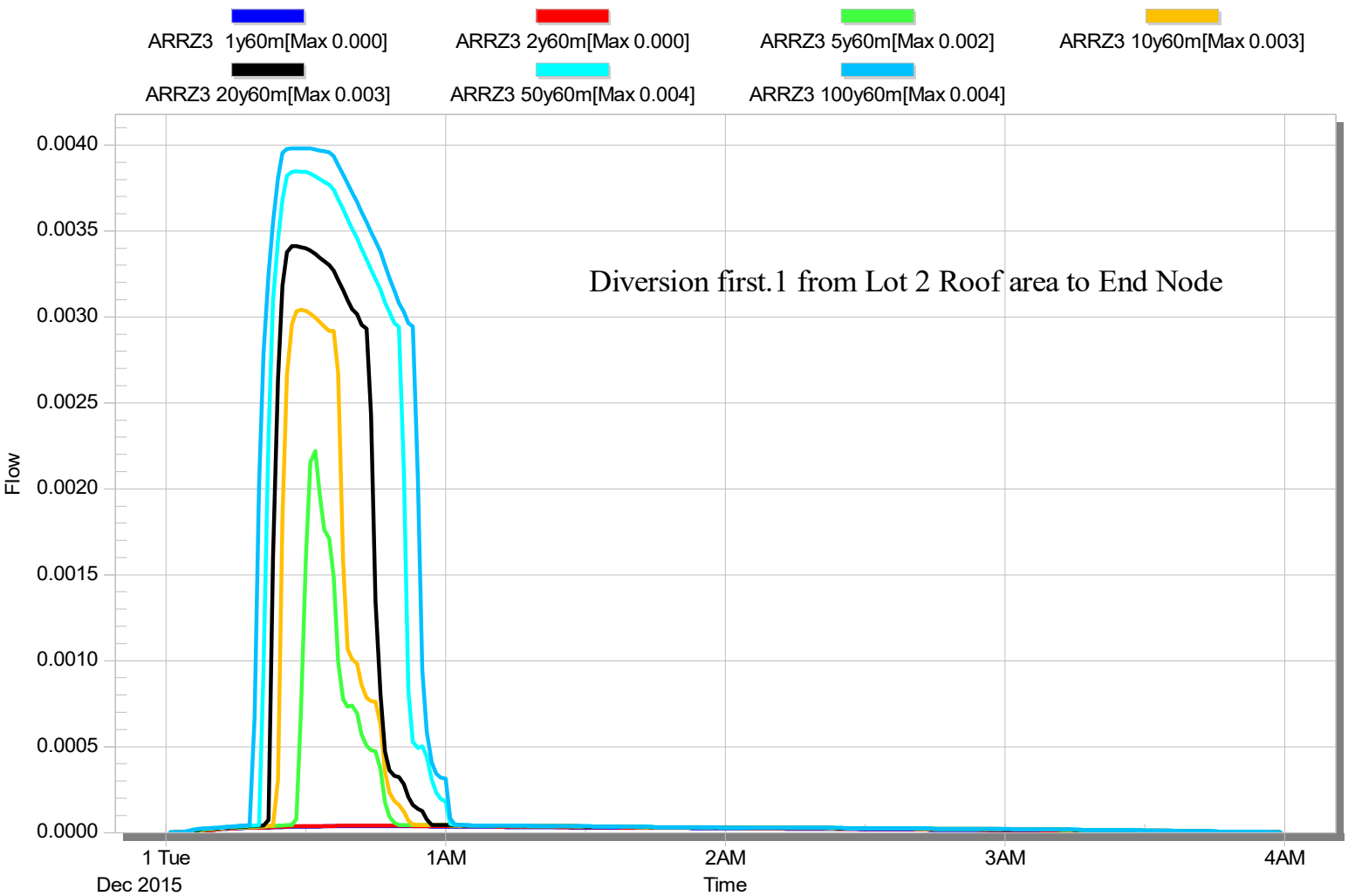
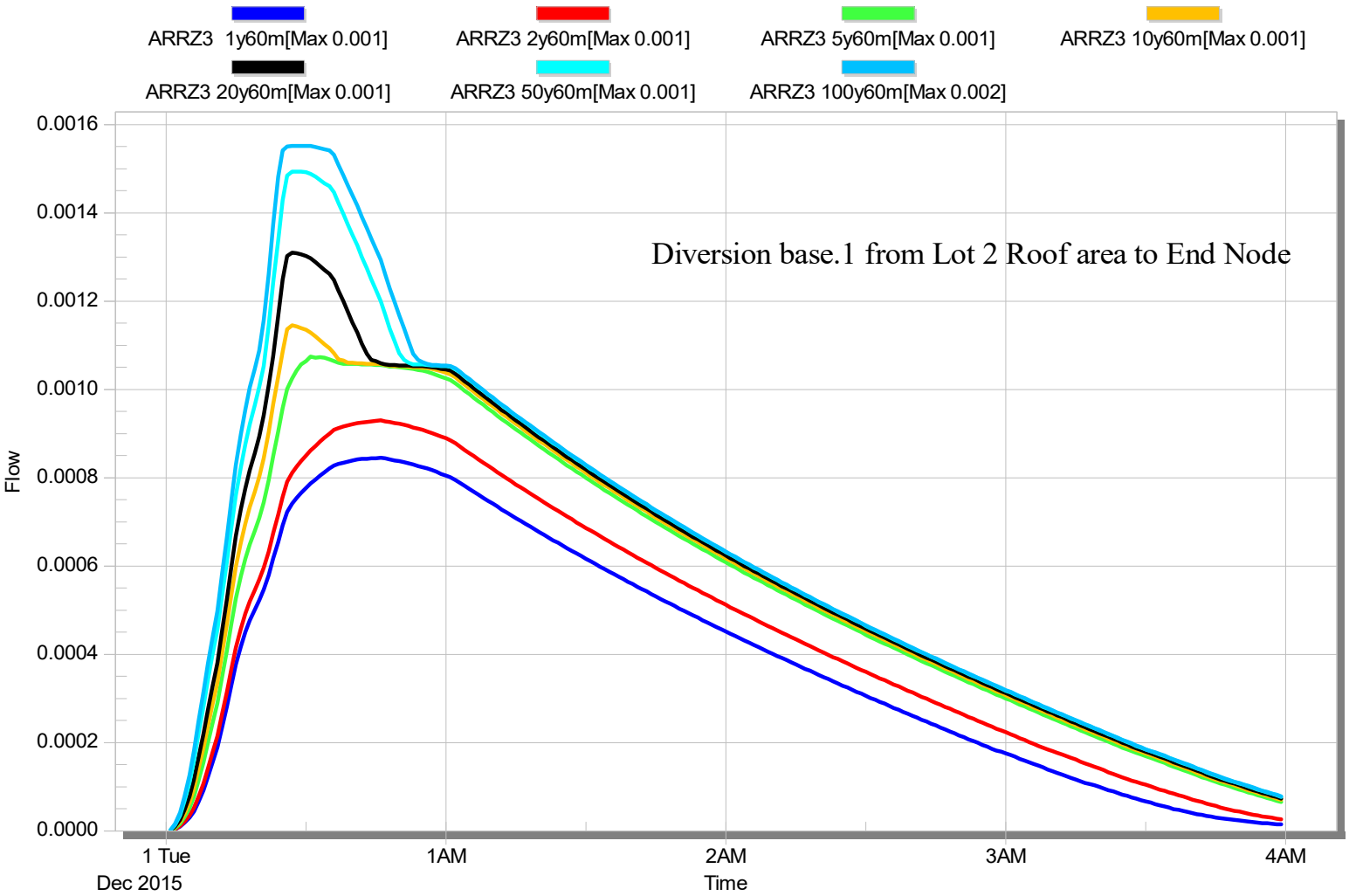
ARRZ3 10y60m[Max 1.252]



Slimline Detention Tank for Lot 2:

Detention tank	Tank base area (m2)	1.15 X 2.60
	Tank internal height (m)	1.86
	Tank Volume (KL)	5
	Base orifice diameter (mm)	20
	Distance to the tank base (m)	0.00
	1st orifice diameter (mm)	35
	Distance to the tank base (m)	0.90

Detention Tank Orifices flows:



Detention Tank flow heights:

ARRZ3 1y60m[Max 0.801]

ARRZ3 2y60m[Max 0.923]

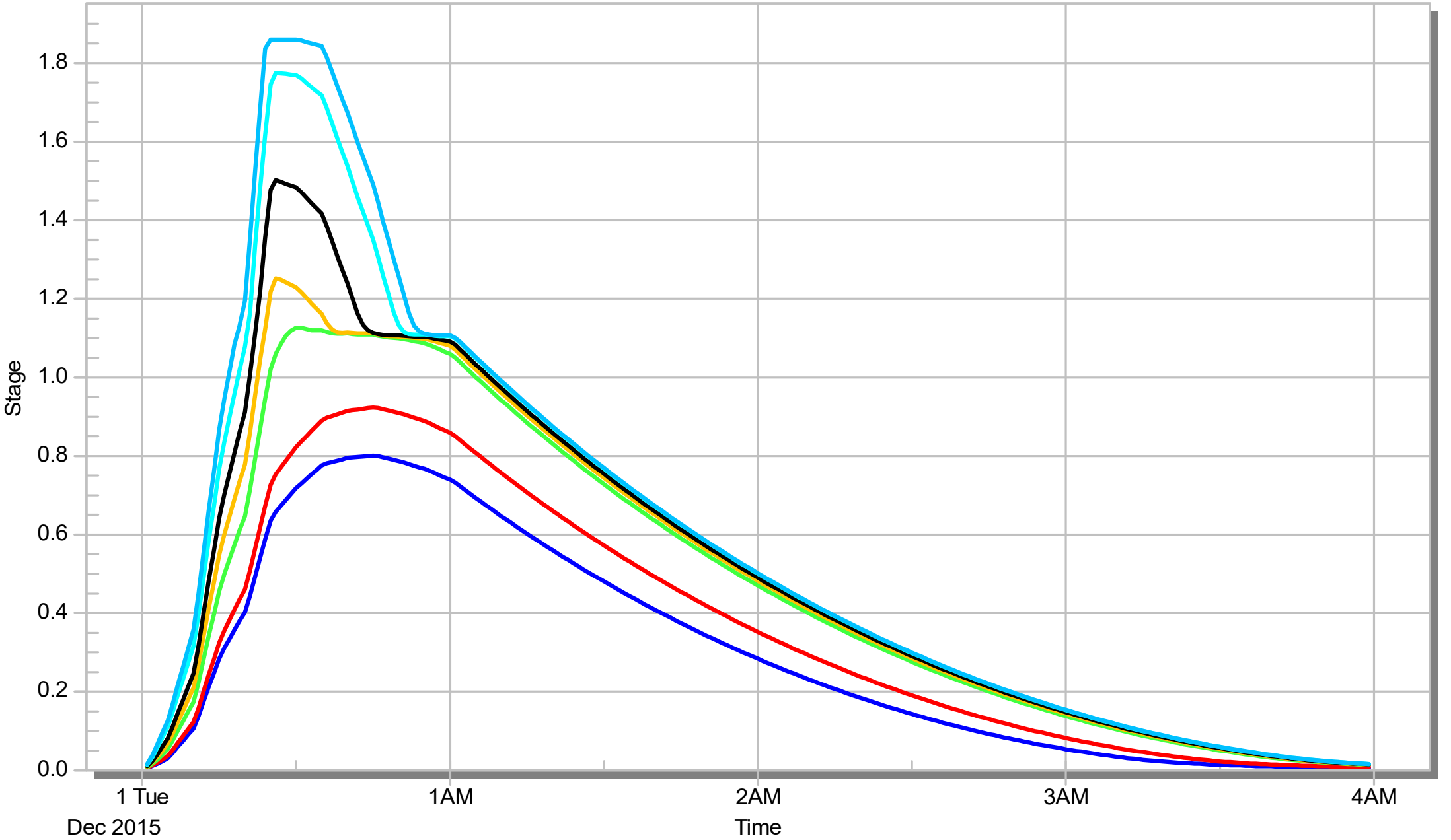
ARRZ3 5y60m[Max 1.127]

ARRZ3 10y60m[Max 1.251]

ARRZ3 20y60m[Max 1.503]

ARRZ3 50y60m[Max 1.775]

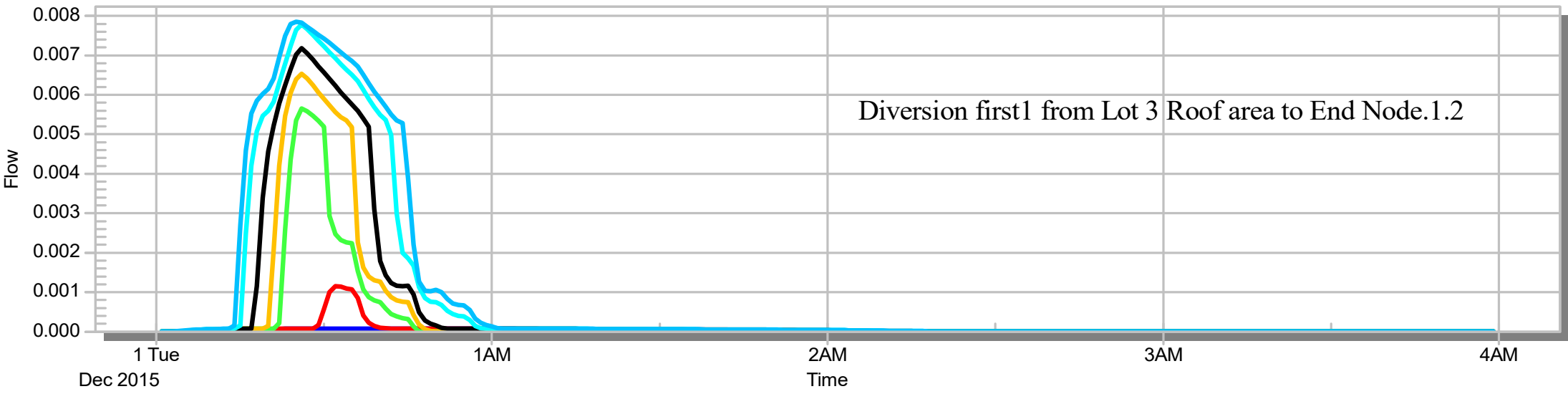
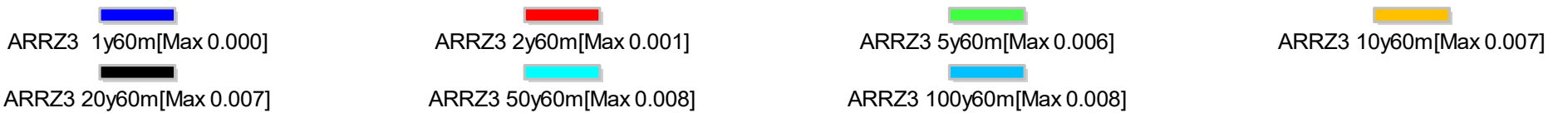
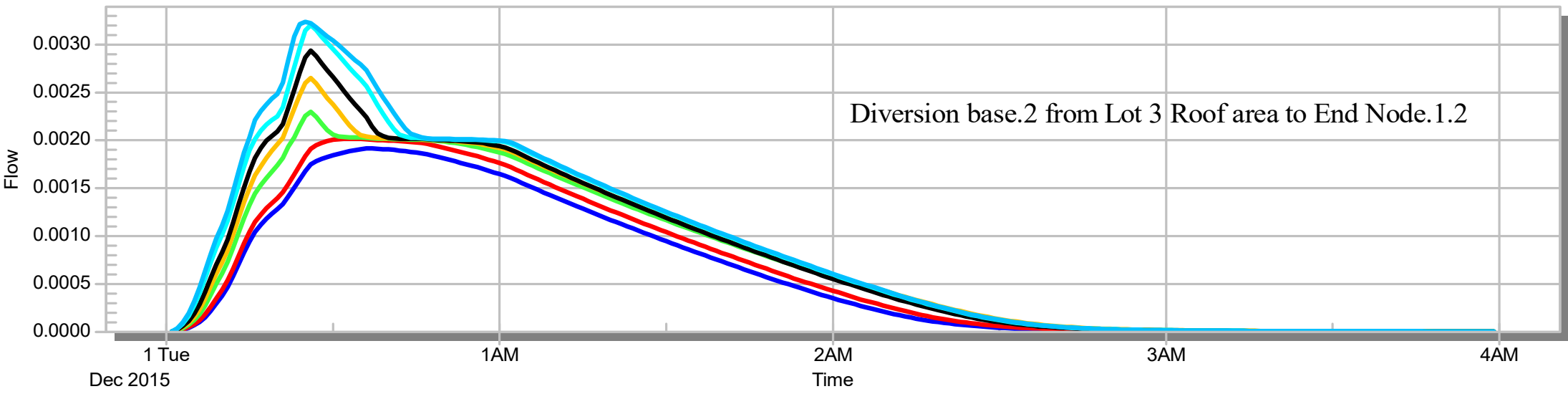
ARRZ3 100y60m[Max 1.860]



Slimline Detention Tank for Lot 3:

Detention tank	Tank base area (m2)	1.15 X 2.60
	Tank internal height (m)	1.86
	Tank Volume (KL)	5
	Base orifice diameter (mm)	20
	Distance to the tank base (m)	0.00
	1st orifice diameter (mm)	50
	Distance to the tank base (m)	0.90

Detention Tank Orifices flows:



Detention Tank flow heights:

ARRZ3 1y60m[Max 0.844]

ARRZ3 2y60m[Max 0.915]

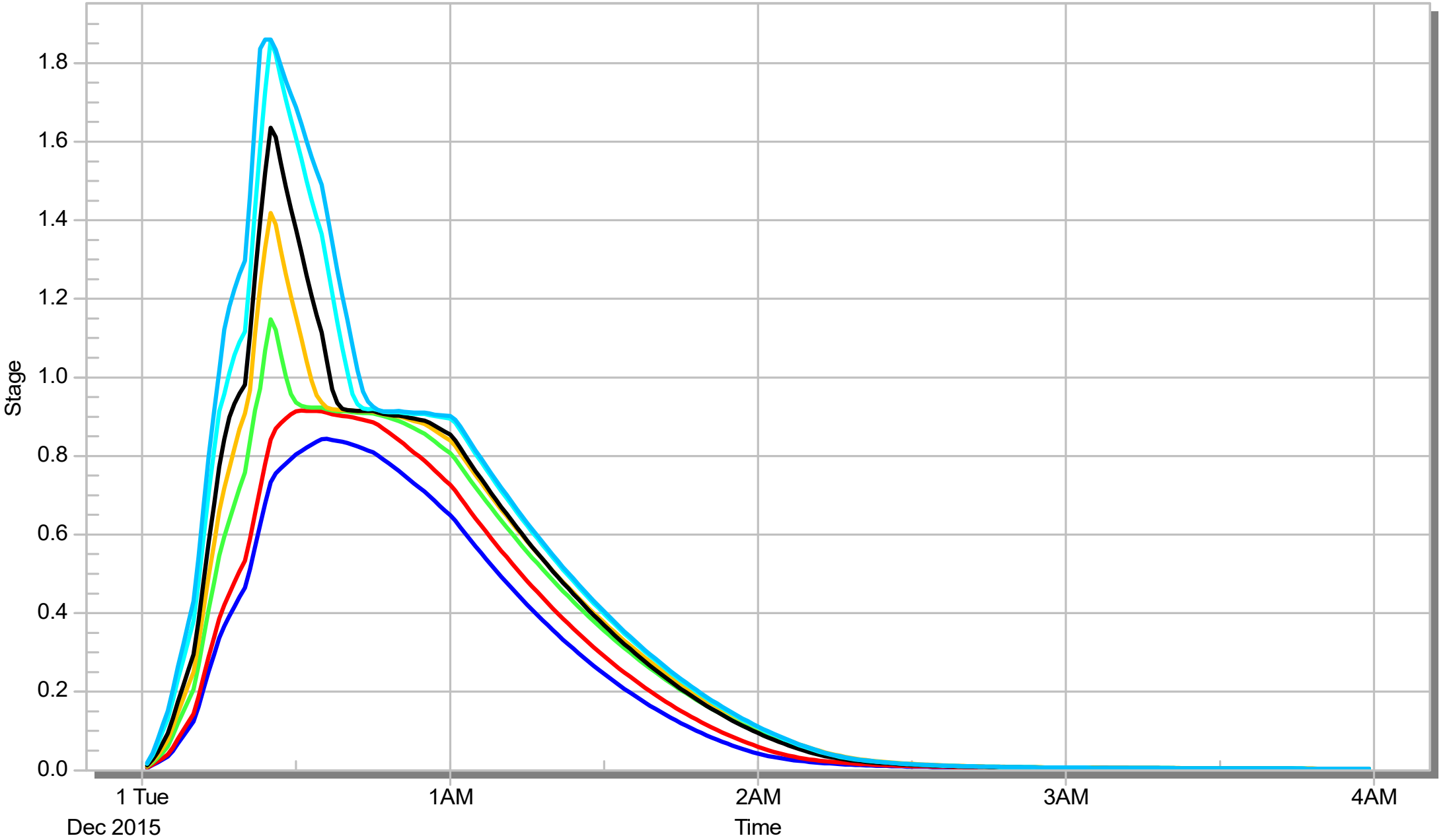
ARRZ3 5y60m[Max 1.148]

ARRZ3 10y60m[Max 1.418]

ARRZ3 20y60m[Max 1.635]

ARRZ3 50y60m[Max 1.858]

ARRZ3 100y60m[Max 1.860]

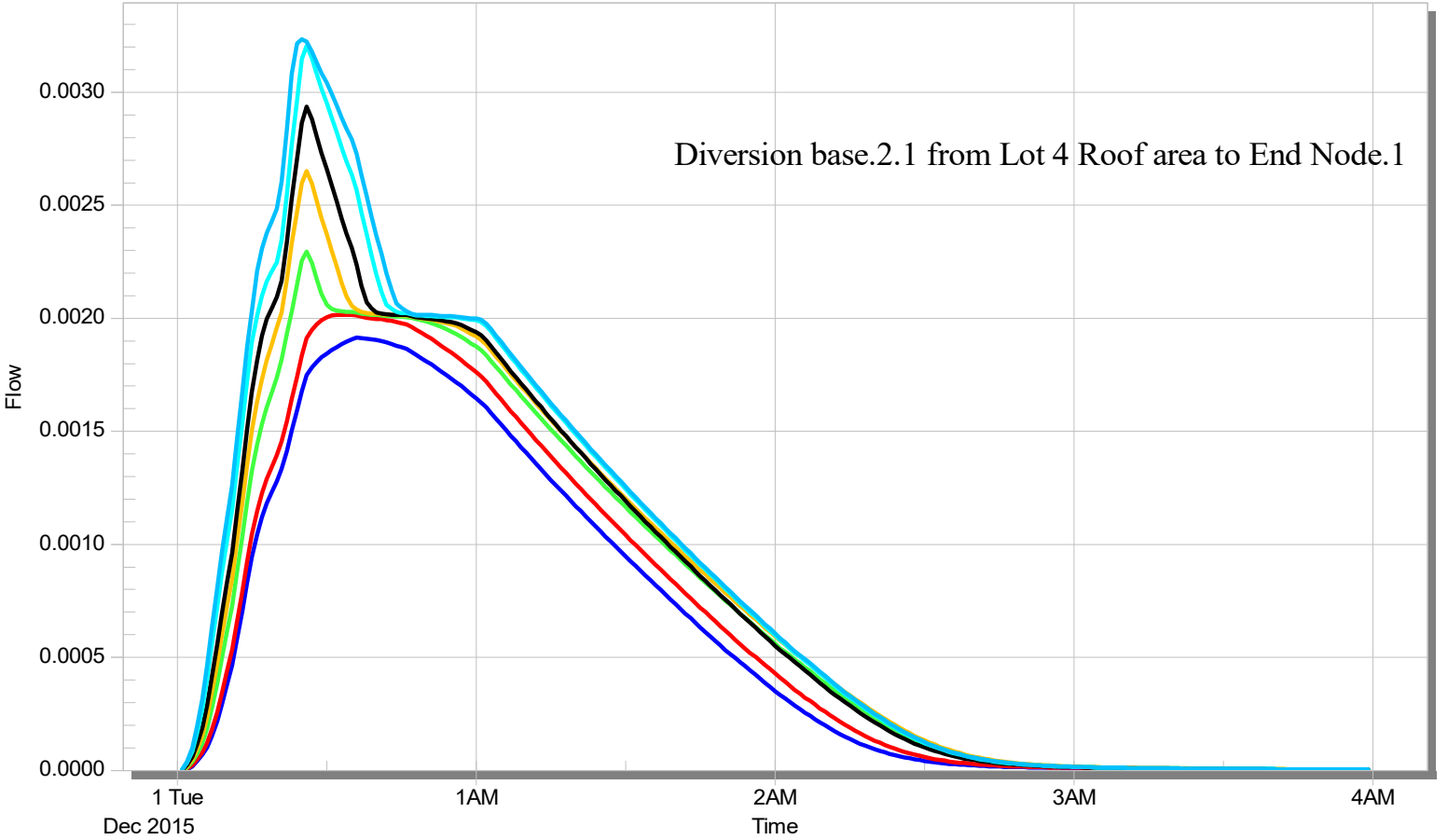


Slimline Detention Tank for Lot 4:

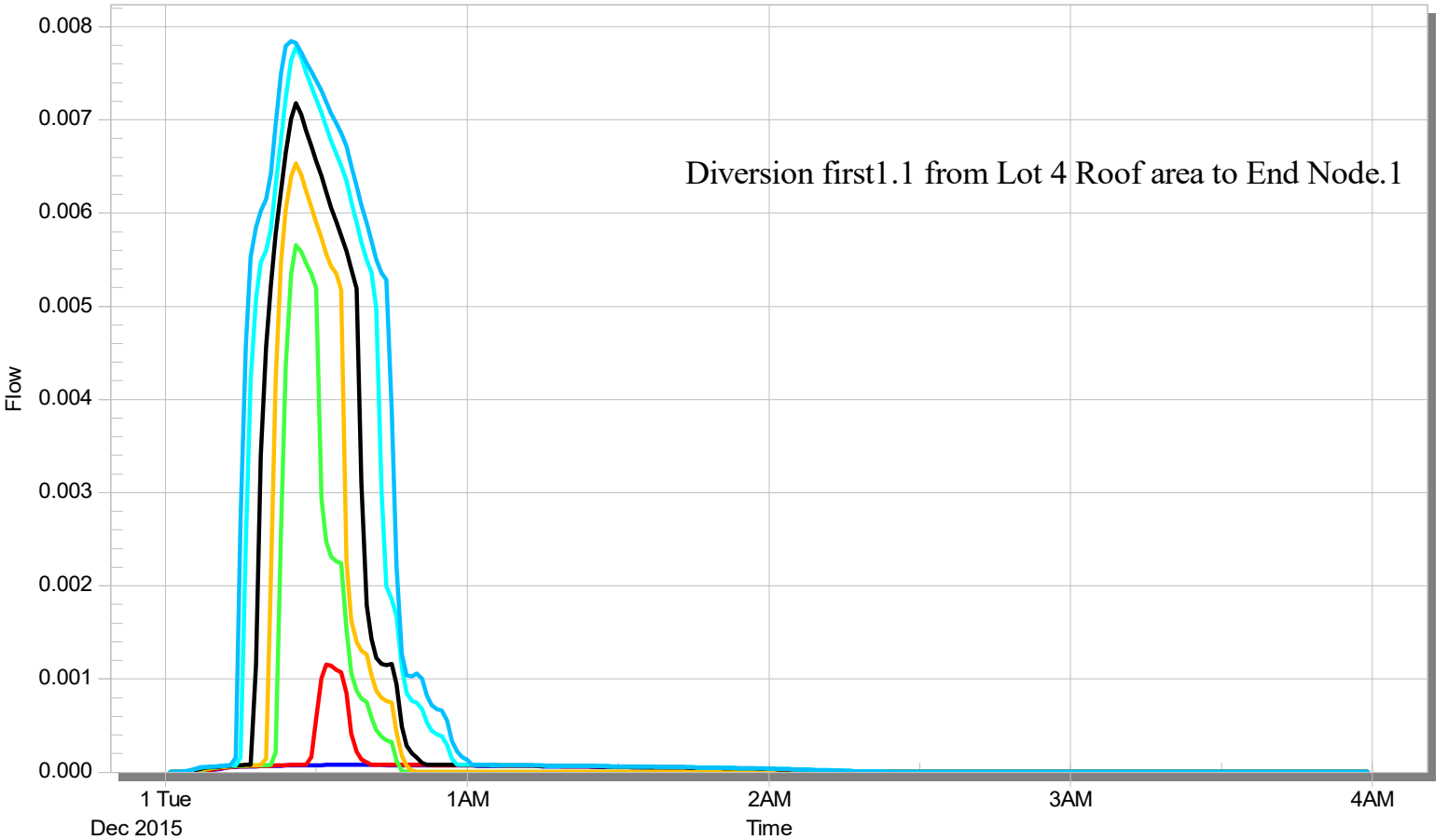
Detention tank	Tank base area (m2)	1.15 X 2.60
	Tank internal height (m)	1.86
	Tank Volume (KL)	5
	Base orifice diameter (mm)	20
	Distance to the tank base (m)	0.00
	1st orifice diameter (mm)	50
	Distance to the tank base (m)	0.90

Detention Tank Orifices flows:

- ARRZ3 1y60m[Max 0.002]
- ARRZ3 2y60m[Max 0.002]
- ARRZ3 5y60m[Max 0.002]
- ARRZ3 10y60m[Max 0.003]
- ARRZ3 20y60m[Max 0.003]
- ARRZ3 50y60m[Max 0.003]
- ARRZ3 100y60m[Max 0.003]



- ARRZ3 1y60m[Max 0.000]
- ARRZ3 2y60m[Max 0.001]
- ARRZ3 5y60m[Max 0.006]
- ARRZ3 10y60m[Max 0.007]
- ARRZ3 20y60m[Max 0.007]
- ARRZ3 50y60m[Max 0.008]
- ARRZ3 100y60m[Max 0.008]



Detention Tank flow heights:

ARRZ3 1y60m[Max 0.844]

ARRZ3 2y60m[Max 0.915]

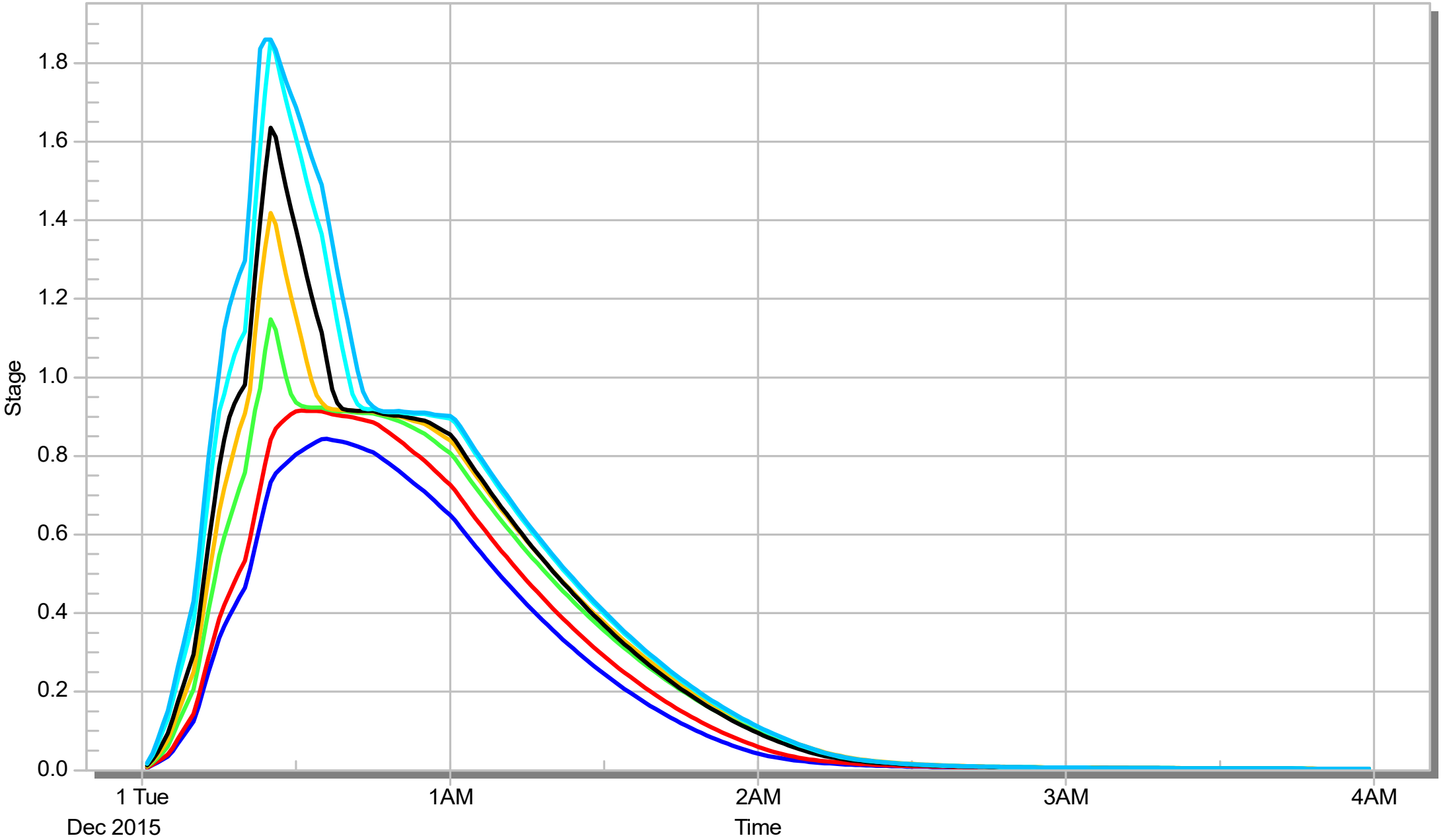
ARRZ3 5y60m[Max 1.148]

ARRZ3 10y60m[Max 1.418]

ARRZ3 20y60m[Max 1.635]

ARRZ3 50y60m[Max 1.858]

ARRZ3 100y60m[Max 1.860]



APPENDIX F STORMWATER CONCEPT LAYOUT PLAN

DO NOT SCALE. CONFIRM ALL DIMENSIONS ON SITE. Copyright

REV.	AMENDMENT	BY	DATE
PA	PRELIMINARY ISSUE	TG	01.12.20
PB	PRELIMINARY ISSUE	TG	17.03.21

LEGEND	
	EXISTING SEWER LINE & MANHOLE
	EXISTING TELSTRA
	EXISTING OPTIC FIBRE
	EXISTING WATER
	EXISTING STORMWATER
	EXISTING GAS
	EXISTING OH ELECTRICITY
	EXISTING UG ELECTRICITY
	EXISTING KERB INVERT
	EXISTING CONTOURS
	EXISTING CONCRETE
	EXISTING BUILDING LINE
	EXISTING BUILDING ROOF
	EXISTING RETAINING WALL
	FIRE HYDRANT
	PROPOSED SWALE DRAIN
	PROPOSED DRIVEWAY
	PROPOSED STORMWATER
	PROPOSED SEWER
	PROPOSED WATER SERVICE
	PROPOSED WATER METER
	PROPOSED RETAINING WALL
	PROPOSED EASEMENT
	PROPOSED TOP OF BATTER
	PROPOSED BOTTOM OF BATTER
	PROPOSED SPOT LEVEL
	DESIGN BUILDING GROUND
	DESIGN WATER CONDUIT
	DESIGN ELECTRICAL CONDUIT
	DESIGN TELECOM CONDUIT
	DESIGN HOUSE DRAIN SEWER
	DESIGN ROOF WATER
	DESIGN EDGE OF ROAD KERB

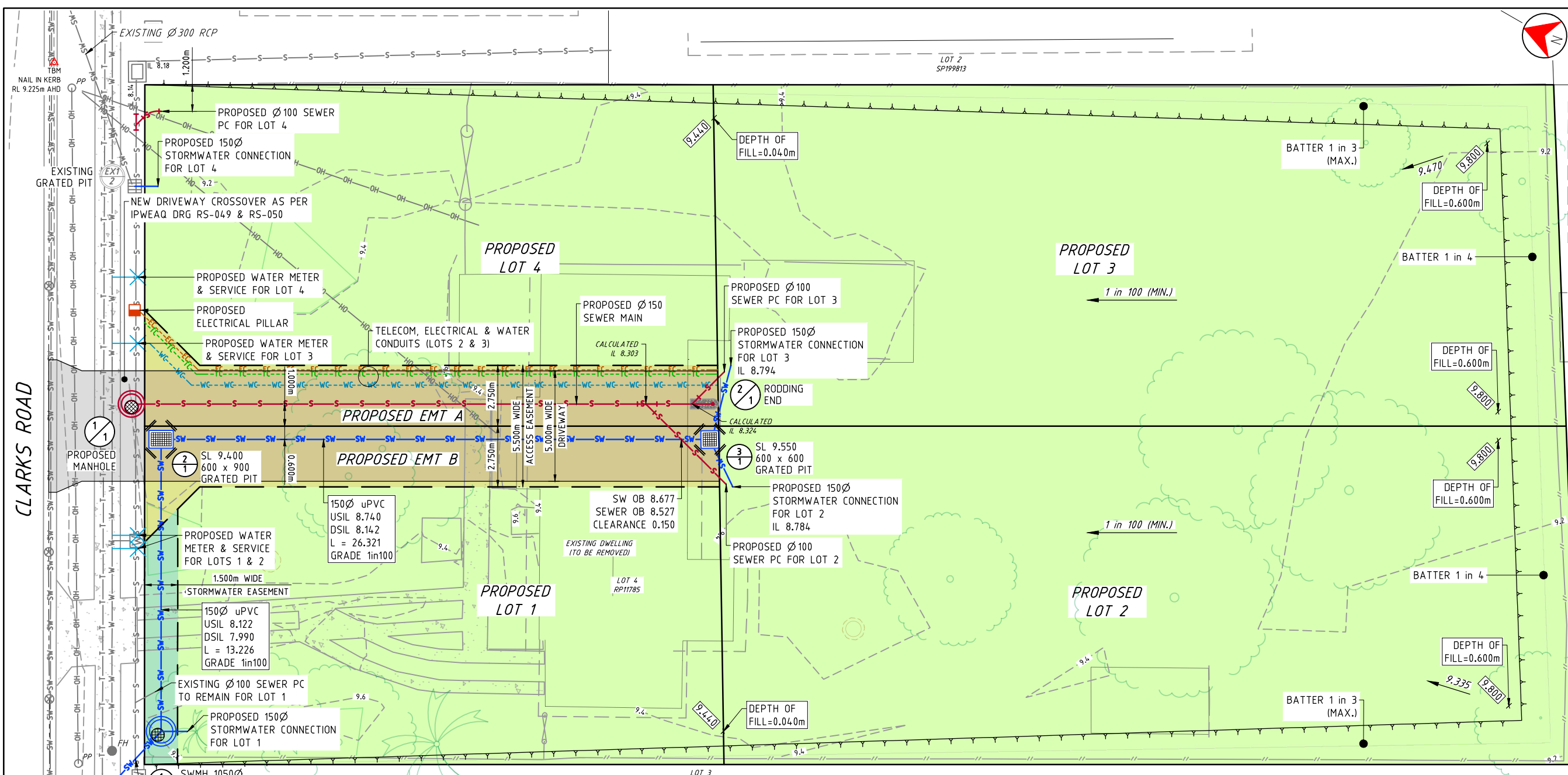
SURVEY INFORMATION
 SURVEYOR:
GM CIVIL & CONSTRUCTION SURVEYING
 DRAWING No.:
C380-SVY-1508101
 VERTICAL DATUM:
AHD
 REAL PROPERTY DESCRIPTION:
LOT 4 ON RP111785
 SERVICES ALSO PLOTTED FROM:



DRW Consulting Pty Ltd
 CIVIL ENGINEERING DESIGN SERVICES
 ACN 083 549 053
 ABN 46 482 504 266
 2/16 Vanessa Blvd, Phone: (07) 3208 8344
 Springwood, QLD, 4127. Fax: (07) 3208 8322
 Email: mail@drwconsulting.com.au

PROJECT SITE:
26 CLARKS ROAD LOGANHOLME

Scale	AS SHOWN	Drawn	TG	Date	27.11.20
Drawing No.	4484-SK01			Rev.	PB



SERVICING LAYOUT
 SCALE 1:100

WARNING!
 SUBSURFACE UTILITY INVESTIGATION SHOULD BE UNDERTAKEN TO DETERMINE DETAILS OF WATER, SEWER AND OTHER SERVICES. ACCURACY OF FINAL DESIGN WILL DEPEND ON THIS BEING UNDERTAKEN.

NOTE:
 INTERNAL PRIVATE WATER CONDUITS ARE SUBJECT TO A PLUMBING & DRAINAGE APPLICATION TO COUNCIL.

NOTE:
 EXISTING WATER METER TO BE DISCONNECTED & REMOVED BY COUNCIL AT THE APPLICANTS EXPENSE. RECONNECTION TO OCCUE AT BUILDING STAGE.

NEW & EXISTING WATER METERS TO BE INSTALLED A MINIMUM OF 1.1m CLEAR OF ANY PROPOSED ELECTRICAL PILLAR. LOCATION OF FUTURE ELECTRICAL CONNECTIONS UNKNOWN AT THIS TIME

CLEAR, UNOBSTRUCTED, TWENTY FOUR (24) HOUR ACCESS FROM THE STREET FRONTAGE IS TO BE MAINTAINED TO ALL SEWERAGE MAINTENANCE HOLES.

THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS CONSTRUCTED INFORMATION. NO POT HOLING HAS BEEN UNDERTAKEN TO VERIFY EXISTING SERVICE LOCATIONS & DEPTHS. IT IS THE CONTRACTORS RESPONSIBILITY TO UNDERTAKE POT HOLING TO VERIFY THE DESIGN.



ISSUED FOR INFORMATION

MAXIMUM DEPTH FOR ROOFWATER PITS	
MAXIMUM DEPTH	RECTANGULAR PIT SIZES / CIRCULAR MH DIAMETERS
LOGAN CITY COUNCIL (REFER TO IPWEAQ STD DRG DS-001 - DS-082)	
0000-1000	600x600 [LCC]
1000-1500	900x600 [LCC]
1500-2000	900x900 [LCC]
<2000	1050Ø WITH 600Ø GRATE [LCC]
LOGAN CITY COUNCIL MAY ACCEPT 300x300 PIT FOR PROPERTY DRAINAGE AS PER IPWEAQ-DS-050.	
IF PIT DEPTHS DIFFER ONSITE TO LEVELS & DEPTHS SHOWN ON DESIGN, THE THE CONTRACTOR IS TO CONTACT DRW CONSULTING FOR CONFIRMATION OF CORRECTED SIZES.	
PITS ARE NOT TO EXCEED MAXIMUM DEPTHS AS SPECIFIED	

